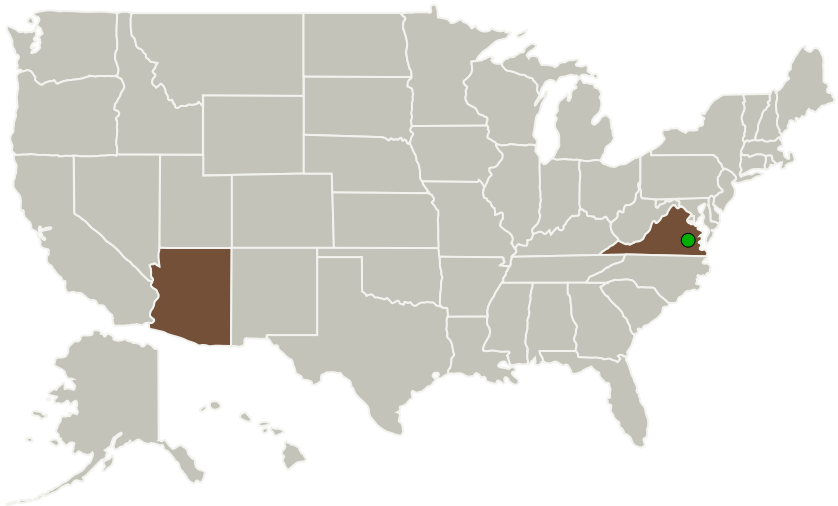
Innovative Structural and Material Concepts for Low-Weight Low-Drag Aircraft Design, Phase I

Completed Technology Project (2013 - 2013)

Project Introduction

The overall objective of this multi-phase project is to explore, develop, integrate, and test several innovative structural design concepts and new material possibilities that will fully leverage the expertise of the ZONA/Boeing Team for enhancing the current state-of-the-art of aircraft design. The technical objectives specific to the Phase I of this effort are threefold. First, a suitable anisotropic composite material will be identified and further studied for its suitability to the design objectives of this research. A baseline SUGAR aircraft configuration will be thoroughly studied for exploring design possibilities as well as to provide a benchmark for comparing performance improvements achieved by optimization studies performed during later stages. Secondly, the skin of the baseline SUGAR wings will then be modified to comprise of the anisotropic composite material, and the FE model will be modified to comprise of (1) distributed multiple control surfaces for AAW-type optimization in Design Route 1, and (2) variable camber continuous trailing edge flaps (VCCTEF) for control output optimization in Design Route 2. The updated FE models will then be used to further optimize the composite layup sequence as well as skin thicknesses. Thirdly, the distributed control surfaces and the VCCTEF on SUGAR high aspect ratio wing will be separately optimized for control input to achieve load alleviation and drag reduction. These two separate optimization processes of Design Route 1 and Design Route 2 will be performed iteratively to achieve an optimum low-drag low-weight design. Finally, once the optimum designs are obtained, a detailed performance review will be conducted to quantify the benefits of the non-conventional design technologies explored. A material fabrication feasibility study will also be performed.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
ZONA Technology, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Scottsdale, Arizona
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Arizona	Virginia

Project Transitions

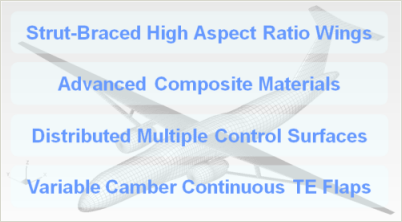
May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140362)*

Images



Project Image
Innovative Structural and Material Concepts for Low-Weight Low-Drag Aircraft Design
(https://techport.nasa.gov/image/132135)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
ZONA Technology, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

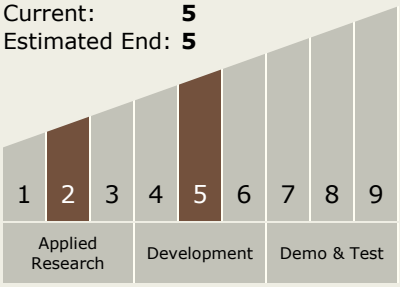
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Satyajit S Ghoman

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.3 Aeroelasticity

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System